TITLE: ECO-AUDIT IN E-LEARNING IMPLEMENTATION OF FSKKP

NG KAH YEE

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Abstract

This project is to develop a Eco-Audit In E-Learning Implementation Of FSKKP. Eco-audit is an examination of activity of an organization affect the environment. To raise the awareness of online learning Moodle users on environmental issues, eco-audit is implementing into online learning system Moodle. Thus, the eco-audit is built with the function for paper pages measurement on their action during the use of Moodle. Main purpose for develop the Eco-audit tool is to increase the awareness and knowledge of eco-audit among students and lecturers through eLearning by using data visualisation. This eco-audit will be helping to beneficial the actions and activities of online users in online learning system which related to text deliver action such as quiz, assignment and file resources module. In a nutshell, user can review their detail of saving paper and realise their activities using Moodle is beneficial to environment.

Keywords: Eco-audit, Moodle, Paper Measurement

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Introduction

With the increasing of use of technology-based learning through internet, it is very significant to show how well the technology had helped the environment (Shakila, 2012). In general, students and lecturers are showing their positive attitude toward the implementation of eLearning Moodle and hence cause the increase of used of technology-based learning and teaching (Hammoud, Love & Brinkman, 2008). Hence, the purpose of doing this project is building a mechanism for doing measurement of calculating the number of paper documents pages throughout the whole system of eLearning Moodle. Besides, many of the studies presented were conducted to examine the satisfaction of eLearning Moodle users to increase the frequency of logging in and using the eLearning Moodle system. Data visualisation will be developed with the implementation of paper measurement to increase the satisfaction and usage frequency of users. It help to increase the awareness to eLearning users no matter students or lecturers that they are doing some contributes to the environment with make full and good use of eLearning. This is also investigating students and lecturers' attitudes towards using eLearning.

1.1 Problem Statement

According to a 2010 study by the U.S. Environmental Protection Agency, paper and paperboard account for 29 percent of the 250 million tons of total Municipal Solid Waste (MSW) in United States alone. The consequences of paper usage without control are harmful to the environment and it is also speed up the loss of our green trees and jungles.

The implementation of technology-based eLearning Moodle among educational institutes is enhancing the speed of knowledge and information cross over among lecturers and students. Hence, the documents and files uploaded and downloaded using the web course tools is considered to be part of virtual paper which just transform and used in electronic format. It is helping to save paper since the fact is showing if there are 12,500 sheets of paper used, one tree can be saved up without notice (TechSoup, para.3).

However, students and lecturers have not exposed to this knowledge widely and they also have low awareness that implementation of online learning help in solving environmental issues

(Olusegun and Sharma, 2006). Although the government has begun to become society's many initiatives to promote green ICT, it still is quite challenging government policy due to lack of their awareness and power [26]. They do not realize that the importance of eco-audit using eLearning since there is no virtual data showing the measurement of paper sheets to them in current eLearning system.

Based on argument above, the awareness among eLearning users on environment issue should be impressing through an eco-audit tool so that making the eLearning system more meaningful in term of eco-friendly..

1.1.1 Objective

A few objectives have been identified to accomplish the aim of the study:

- As a mechanism to display the total pages of paper saved with calculate number of log of each quiz, file resources, and assignment used in eLearning system.
- To increase awareness and knowledge of eco-audit among students and lecturers through eLearning by using data visualization.

1.1.2 Scope of project

The scope of the project is as follows:

- ✓ eLearning Moodle of Fakulti Sistem Komputer & Kejuruteraan Perisian of Universiti Malaysia Pahang
- ✓ students and lecturers of Fakulti Sistem Komputer & Kejuruteraan Perisian that using eLearning Moodle
- ✓ data log of eLearning Moodle FSKKP within one year

1.2 Literature Review

1.2.1 Energy-aware Co-Operative (ECO) Relay-based Packet Transmission in Wireless Networks (Review of previous research and relationship to Save Energy in term of Eco-Audit)

The first previous work we found in our research work is about the existing system that helps in energy saving using ICT tool. It is in a wireless network which titled Energy-aware Co-Operative (ECO) Relay-based Packet Transmission in Wireless Networks. This is mainly describing the pattern of how the ECO-Relay helps in saving and reducing energy consumption during data transmission from the Access Point (AP) especially for mobile devices. In order to have energy saving result, clients would not communicating directly with AP but using relay to forward its data since that the energy consumption between client and relay is just need only a fraction of single-hop transmission power. This research is comparing ECO-relay with the other two type of way of data transmission within the wireless networks which areminimum-energy path (MnEP) and maximum-residual-energy (MxRE). MnEP is minimizing total consumed energy when transmitting given packet but it is found that there is obvious power depletion in those nodes [22]. Whereas MnRP does in maximizing network life by select those nodes that have most residual energy but it doesn't help much in forwarding to individual nodes selected.

ECO-algorithm has three assumptions in order to reducing energy consumption. There are all nodes are within the range of AP, AP has unlimited energy and AP has unlimited consumption power. These entire enable all nodes directly communicate with AP and vice versa to effectively reduce energy consumption. We are mainly consider the energy to reduced is the energy required to transmit data packets from mobile nodes to AP. The high-level view of the ECO-algorithm is as illustrated in Figure 1[22].

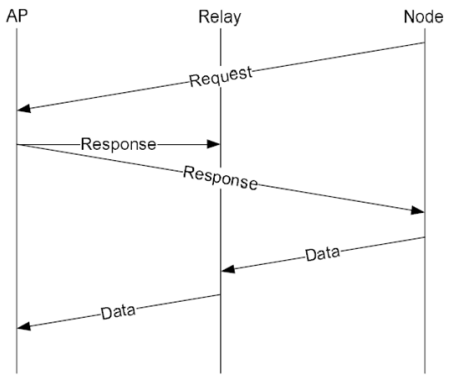


Figure 1.1: Timing Diagram of the ECO-relay Protocol

There are four explanations that describe how the energy saves by the ECO-relay. All of them are choosing of the set of potential relay, normalized packet transmission cost, relative energy usage (REU) which keeps track of energy balance and the last is on the relay selection (Figure 2) [22]. The result are shown as below with compare ECO-relay and others.

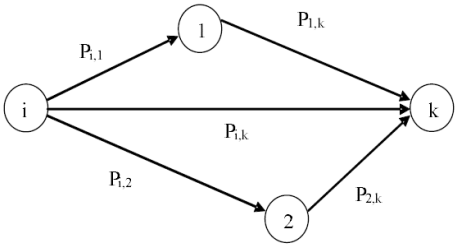
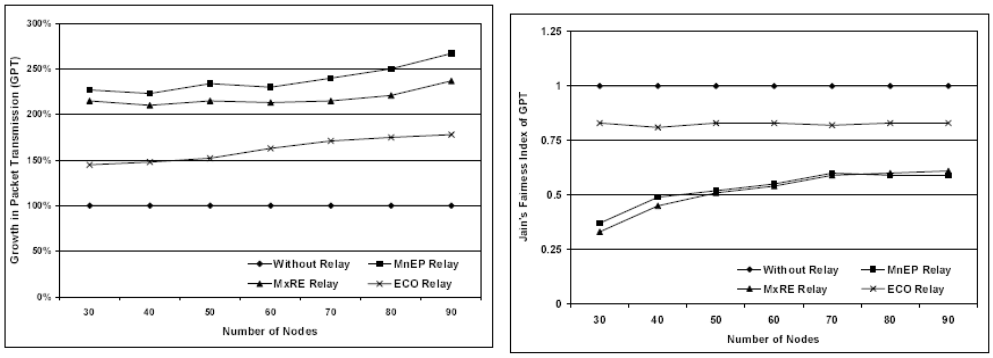


Figure 1.2 Relay Selection

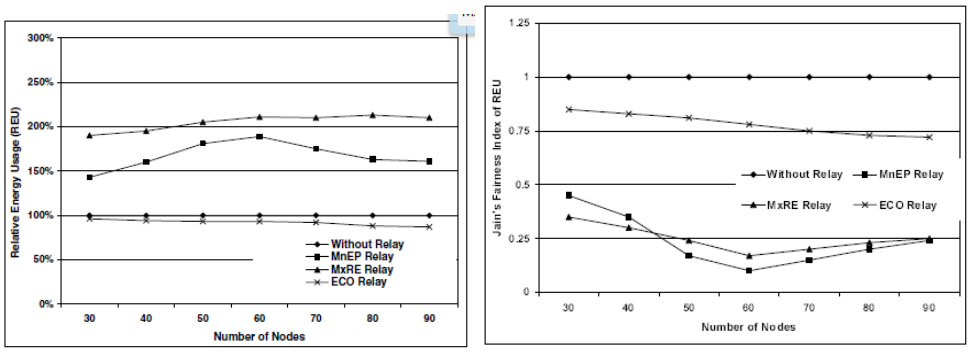
Fig. 3(a) shows that ECO-relay enables 50% more packets to be transmitted for the same total energy. While MnEP and MxRE more than double the amount of data transmitted, as Fig. 3(b) illustrates, they can only do so by being extremely unfair. ECO-relay thus benefits many nodes, and spreads the cost fairly, both of which critical requirements for are protocol adoption in a commercial network.The average behaviour of REU is shown in Figure4.



(a) Average growth in packet transmissions.

(b) Fairness of the growth in packet transmissions.

Figure 1.3 Growth in packet transmissions



(a) Average relative energy usage.

(b) Fairness of relative energy usage.

Figure 1.4 Relative Energy Usages

1.2.2 Deforestation and Reforestation Monitoring (Review of previous research and relationship to Save Trees in term of Eco-Audit)

The next research paper that done by HaboudaneandBahri with the existing system that save cutting trees that found and is related to our topic is the use of ICT in doing deforestation mapping system and forest degradation [25]. This found to be help monitoring the deforestation and reforestation areas of the forest in order to manage landfill and reduce cutting trees.

The vegetation index used is developed by [24] as an improved soil adjusted vegetation index (SAVI) called MSAVI, with a self-adjustment factor L that does not appear in the formulation of MSAVI (Eq. (1)) where R and NIR represent red and near-infrared reflectance. Obtained MSAVI images were used to detect the change from forest cover to bare soil and vice-versa. By the way, this system was using multidate satellite images (Thematic Mapper (TM), Enhanced Thematic Mapper Plus (ETM+), and Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER)) with the use of maximum likelihood classification (MLC) and spectral mixture analysis (SMA). Besides that, the system is aim to interpret out image products differencing to assess the overall change in the forest cover, as well as post classification comparisons using the outputs of the MLC and the relative abundances of forest species as determined by SMA. It is mainly used for sustainable management of Middle-Atlas cedar forest which requires the improvement of its database quality and implements the new approaches for detection and monitoring of forest changes and decline damages. This system studied the forest change detection using vegetation index differencing, post-classification comparison, and the differencing of the relative abundances generated by spectral unmixing. The study area of this research paper is located in the Middle-Atlas Mountains of Morocco.

This system is using satellite imagery to view the visualization of the deforestation and reforestation area in the specified area. The satellite multispectral imagery like Landsat Thematic Mapper (TM) image acquired August 27, 1987, Landsat Enhance Thematic Mapper Plus (ETM+) image acquired August 20, 1999, and Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) acquired September 9, 2003 are purchased to retrieve all the information of the image. It was geometrically rectified, registered to UTM co-ordinates, and radiometrically corrected using image processing software ENVI [23]. The corrected multidate images were then used to generate the products needed for change detection in cedar forests using the following procedures: vegetation index calculation, Maximum likelihood classification (MLC), and spectral mixture analysis (SMA).

There are some results on the paper which discover forest cover change by using vegetation index differencing technique. The images shown Figure 1.5 and Figure 1.6 are the images of the vegetation index MSAVI computed for the three dates of 1987, 1999 and 2003.

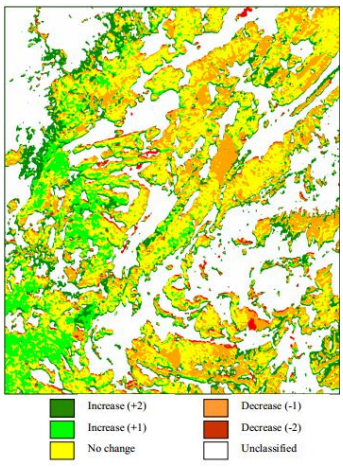


Figure 1.5: Change detection obtained by MSAVI index differencing between 1987 and 1999. Forest cover change categories +2, +1, -1, and -2 represent following ranges of cover change: more than 50%, 5% to 50%, -50% to -5%, and less than -50%, respectively.

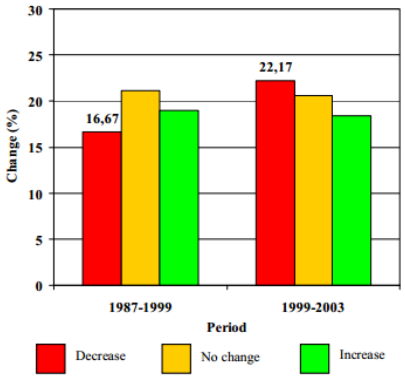


Figure1.6: Summary of change detection reports obtained from vegetation index (MSAVI) differencing for the periods 1987-1999 and 1999-2003.

Through the figure above, we can clearly know that how we can control the logging and number of trees in the cover of forest area to protect the environment.

1.2.3 Green IT Framework (Review of previous research and relationship to Save Environment using ICT in term of Eco-Audit)

The third research and existing systems we found is in the Green IT Framework research [30]. The purpose of this paper is to show the development of the prototype system to monitor the Malaysian public sector employees between green and sustainable IT ecosystem behavior, because it can support the monitoring process that Green IT framework. Furthermore, this monitoring tool for green IT strategy is very important as Ahola [26] proposed "Empowering People" can raise people's awareness of the environmental impact of their behavior, and to guide their behavior in a more environmentally friendly direction. For instance, Malaysian Administrative Modernization and Management Planning Unit (MAMPU) is another government agency that takes a number of measures to promote green IT in Malaysia. The following figure 1.7 is the Green IT Framework [27].

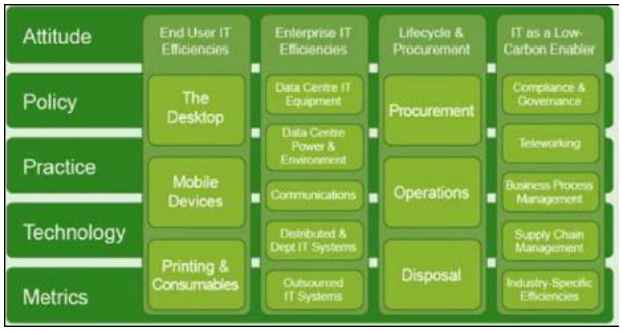


Figure 1.7: Green IT Framework [27]

The first existing system which is related to Green IT and sustainable purpose is the Energy Calculator for PC Equipment. It is a system development and use, by the European Commission to monitor the energy consumption of ICT equipment. In detail, information is obtained in the system regarding PC power supply, monitor power and the use of time. PC and monitor display the drop-down list, and will require the user to select one of four preset equipment. On the value of the sleep and shutdown modes, as well as the purchase price will be adjusted automatically. The user can change the value of the equipment, on the basis of the specific value of the user or plan to buy. This also applies to "use" column, in the drop-down list to default for the typical day-to-day use. After all data are fill by the user, the calculate button must be hit to get it result. The system is used only for the purpose of monitoring the green, there is no any other activity in this system involved. The system uses ASP language and Microsoft SQL development.

The second existing system which is related to Green IT and sustainable purpose is the Green Computing Energy Usage Calculator. The CoSN's Web-based energy use calculator provides a quick method estimated kilowatt-hours per year, the use of computer-related costs K-12 users (group) and related data center infrastructure. The system allows the user to enter a variety of types of information and communication technology equipment, for example, desktop, projector, monitor type, notebook computers, printers, photocopiers, servers, network switches, ports, routers, power and many more. Energy usage count is the number of power based on the activation of the equipment, the average utilization rate, hours or days and hours or days. All the requirements in the green, the use of information and communication technology equipment, power consumption and cost calculations. The system not only calculates energy use, but either in pounds or metric tons of carbon dioxide emissions. Using the system, the user must enter the number of the equipment used and the active second-hand equipment, every hour, or a day, a few days or a few years. Users also need to enter how many hours a day, their equipment supply. System all the necessary information is input, and then can calculate the annual energy use and the total energy costs. The UI are shown in Figure 1.8 and Figure 1.9.

Figure 1.8 : First UI of Green Computing Energy Usage Calculator

Figure 1.9: Second UI of Green Computing Energy Usage Calculator

1.3 Explanations of terminology

1.3.1 Conceptual Meaning of Environmental Audit (Eco-audit)

The audit, unconcerned of its nature, needs the audit philosophy, which is commitment to this technology practice of social norms and joint investment. Society is more and more promise to abide by the various audit practice. One of the significance audits using today is the environmental audit which is also called eco-audit.

Following the International Chamber of Commerce 1991, eco-audit is described as a management tool used in performance of environmental organizations, managements and equipment that consisting a systematic, documented, periodic and objective evaluation for the purpose to help safeguard the environment: by promoting management control of environmental practices and those agreement with company policies [2]. In Confederation of British Industry, eco-audit is meant to the economic and environmental operations having interaction to build with a systematic examination.

Environmental audit is also a process that is systematic and documented to verify audit evidences attained and assess impartially for determination whether all tasks of established in environmental management system are correspond to audit criteria[3].

According to the Council of the European Union on 1993, eco-audit is defined as a management tool used for controlling the practices that impact the environment which including a systematic, documented, objective and regular evaluation of the entity's performance, management system and process designed to safeguard the environment[3].

In our opinion, eco-audit can be defined as a systematic analysis that documented all the performances and activities of an organization that have interaction with the environment for its improvement and regular conduction in consideration of avoid the risk of failure related to environmental regulation.

1.3.2 Circumstances of making eco-audit

Due to the issues on environmental audit are increasing exponentially from time to time, there is significance for scientific research to look up for their solution or answers to immediate problems as well as theorizing environmental issues with reasonable ways. These may also become an important resource of information for auditors during the preparation of audit report and audit opinion on the audited financial statements [3].

Besides, people must be responsible for their actions, and this responsibility must justify as there is the concept of rational behind this commitment. The eco-audit tool has transformed from a simple tool used by organizations to a management based form of self-assessment, giving priority to systems and self-informing [1].

1.3.3 The history and involvement of people and entities in eco-audit

Environmental audit is involving with four stages from the year of 1970. The four stages are started from Stage I (1970-1980), Stage II (1981-1994), Stage III (1995-2001) and Stage IV (2002-onwards). The concept of eco-audit start developed well during stage III since there is widely exposure and approaches about eco-audit especially among developed countries [3].

The awareness of environment intimidation has comprised among a large scope and number of population and enterprisers as discussed in Conference in Stockholm in 1972 [3]. Consequently, the approach of eco-audit emerged, initially meant compliance with environmental legislation. Eco-audit was conducted in 1970s in U.S.A. and its concept is being mature as well [3].

1.3.4 The methods and the structure of stages of making eco-audit

For an environmental audit to be built, it is consider either in quantitative or qualitative analysis. For example of qualitative analysis, this is a comparative method which targets the presentation of eco-audit's stages and the stages of financial audit. One of the ways is synthesis, by drawing conclusion and explains by valuating the involvement of auditors in environmental audit with the main predicaments. Another one is case study method. This is doing in presenting the involvement of accounting professional in eco-audit. Next is questionnaires method which used by Todea, Stanciu and Joldoş (2011) that send to entities in Romania to analyse on environment in terms of the importance given to environmental issues by entities in Romania [3].

Generally, environmental audit is consisting of four stages which are "client acceptance", "planning the audit", "testing and evidence" and "evaluation and reporting" stated from U.S. auditing standards and the International Standards on Auditing [4]. The following table is the structure describing the detail of each stage.

Stages of Eco-audit	**Description**
Client Acceptance (Pre-Audit Activities)	❖ Select and schedule facility to audit ❖ Select audit team members
Planning the Audit (Activities on-site)	❖ Contact facility and plan audit ❖ Identify and understand management control system ❖ Assess management control system
Testing and Evidence (Activities on-site)	❖ Gather audit evidence
Evaluation and Reporting (Post-audit activities)	❖ Evaluate audit findings ❖ Report findings to facility ❖ Issue draft report ❖ Issue final report ❖ Action plan preparation and implementation ❖ Follow-up action plan

Table1: Developing Stages of Eco-audit

1.3.5 About eLearning

eLearning is cited in HerridgeGroup as delivering a broad array of training solutions by using the internet or wireless technologies. Marc Rosenberg (2001) stated his definition of eLearning: "the use of Internet technologies to deliver a broad array of solutions that enhance knowledge and performance." (p. 28) [6].

eLearning is becoming more popular, it is not only provide useful educational tool for existing institutions but offering a withdrawing from the traditional classroom. It is an alternative way of learning with different patterns of interaction, and a new way of promoting community [5]. It is mainly focused on learning as a cognitive and individualistic process. Michelle M. Kazmer and Caroline Haythornthwaiteis also describe eLearning as a social process that encompasses multiple players each with an agenda [5].

There are some examples of famous web-based eLearning that used by learning communities such as Moodle, Apple Learning Interchange, Connexions, iBerry and so on.

There are various advantages that become the main reason of people using eLearning becoming widely popular among public. eLearning suits the flexibility of personal schedule since we can access to eLearning regardless the time and place we are as long as there is possibility of internet access. Since nowadays people are having different life and daily routines to work on, eLearning enable one no need leave one's job or family responsibilities because of the course material can be accessed where it is convenient. Besides that, it is addressing out that it can help handle multiple simultaneous commitment when take online courses. eLearning is also can integrate education into one's everyday lives.

Use of online learning has been increase dramatically in term of number of subscribers and number of institutions. For instance, the PEW Internet and American Life Project interpreted that there is at least 5 percent of adult United State internet users had taken a class online for college credit [7]. The main reason is the computer system are becoming easier to use and easy to gain access to Internet from time to time. Besides, Asia countries and other developing countries are also increasing rapidly in the number of online learning users. For example, there is a rapid growth of number of internet users from 2.1 million in 1999 to nearly 96 million in 2004 in China alone [8].

In Malaysia, World Bank reported that there is also an exponential increase of internet users' start from 2.31% of Malaysian population in 1997 to 56.3% of Malaysian population in

2010 [9]. The data is shown in Figure5. Since the internet becoming increasingly common and as a basic necessity of Malaysian, the online learning is worked as a web based educational tools for students in Malaysia start from these current few years.

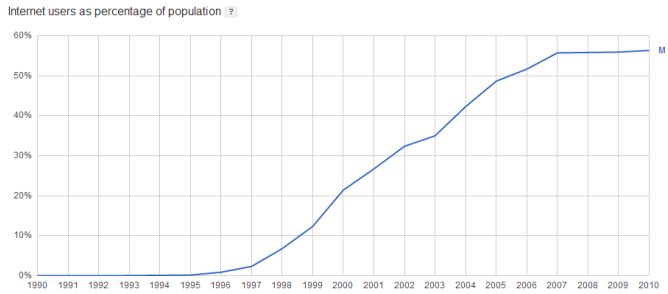


Figure 1.10: Internet users as percentage of Malaysia Population from 1990 to 2010 [9]

In order to reveal the advantages and functions of online learning in educational field, the context of each student's life such as their life stage and commitments to the online learning must be clarify and understand at the first stage of using online learning. We need to know how does online learning influence work and domestic life for students and connect other web tools that help access to online learning, which argued byKazmer and Haythornthwaite [10].

Why we need to alter completely from a traditional classroom teaching to an online learning trend? Why don't we just integrate traditional teaching with addition of online learning? We are using eLearning by supplying information about the course and class notes to the students so that they can be made available online as well as a traditional teaching can be enhanced through message boards for discussions, online office hours, and text messaging. There is showing a continued and increasing role for using information technology in the traditional classroom [10]. Hence, in order to provide a better learning environment and experience, the multiple perspectives framework promotes that online learning communities need to be analysed from diverse viewpoints for students in both way of online and face-to face [5].

On the other hand, there is some constraint of using online learning. For instance, the students' abilities to take part in an online learning community will based on their written communication skills. St. Amant started this with an analysis of language and rhetoric. He claimed that it is critical that those students who with language limitations should be identified at the early stage so that communication problems can be avoided. By using this method, the students will lead by the teachers to improve their communication skills in order to use the online learning tool [5].

Chapter 2

Report Body

2.1 Requirement of users

In order to gather the requirement from our users, we are using online survey among students and education staff in Malaysia. The following are the list of our survey question in the survey form. The real survey form is show in Appendix 1.

1. Do you know about Eco-Audit?
2. Do you think that Eco-Audit can be adopted in online learning system?
3. Based on your opinion, do you think that the current online learning system attracting you to use it?
4. Do you think that current online learning system should give you more information of how far it helps in protecting environment?
5. Do you think you did help in saving paper in your education/career field?
6. What will you want to know about using online learning system in term of Eco-Audit and green computing?
7. Do you feel that there should be an improvement on current online learning system by applying Eco-Audit?
8. From your experience, what do you think you can get to know through current online learning system?
9. I think that Eco-Audit in online learning system provide a lot of information about paper saving to increase users awareness on environmental issues.
10. I will found it is more interesting if I can know the number of paper I can save with using online learning.
11. I will think that online learning system is Eco-friendly in higher education field with implementation of Eco-Audit tool.

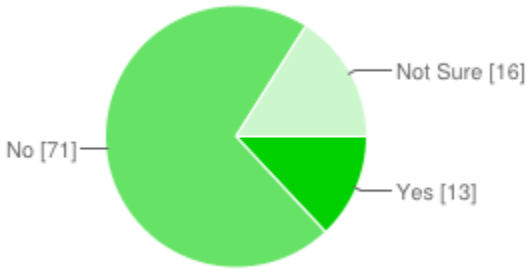
We are collecting the results of the survey and analyse from the survey to get user requirements.

Eco-audit that implement in FSKKP Moodle eLearning are relied on a supporting infrastructure including communication networks, computer hardware and application software. In order to enhance and promoting the information about number of paper sheet save by FSKKP Moodle users, we need to collect data from the data log in Moodle database. The expected collected data log of eLearning Moodle FSKKP is within one year.

For development part, we will insist all the appropriate web development language which consisting HTML, CSS, JavaScript, PHP, SQL and HTML5 to implement the eco-audit. HTML5 is the data visualisation formatting language that display the data visualisation about measurement of paper sheet saved by individual on the interface that going to display to users. All other types of language listed above are needed in process of implementation and play major role in their respective function. Figure6 show the structure of our eco-audit platform in Moodle eLearning.

In order to assess the need and collect data requirement for the first stage of RP methodology, we did the first stage of online survey by using questionnaire. The following are our analysis results which are users based requirement.

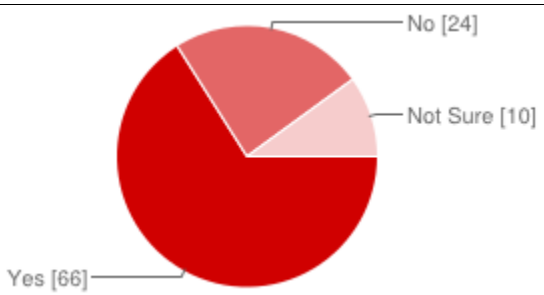
Do you know about Eco-Audit?



Yes	**13**	13%
No	**71**	71%
Not Sure	**16**	16%

Figure 2.1 :Analysis result of whether respondents know about Eco-Audit

Do you think you did help in saving paper in your education/career field?

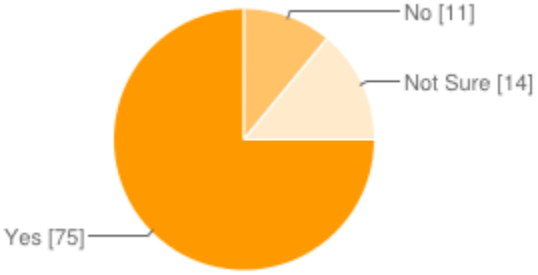


Yes	**66**	66%
No	**24**	24%
Not Sure	**10**	10%

Figure 2.2 :Analysis result of whether respondents did help in saving paper in their field

In figure 2.11, under our survey analysis,we get to know that most people do not know much about Eco-Audit as the chart shown above that there is more than half of the respondents do not know about Eco-Audit. In our opinion, the public is concerned about environment and practice eco-action which shown in Figure 2.12 in helping saving paper in daily life but they just do not clear on how to help more on environment though ICT.

Do you think that current online learning system should give you more information of how far it helps in protecting environment?

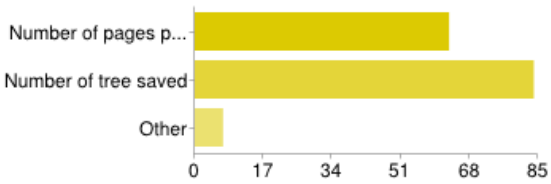


Yes	**75**	75%
No	**11**	11%
Not Sure	**14**	14%

Figure 2.3 :Analysis result of whether respondents feel the online learning system should give more information of how far it helps in protecting environment

Besides, in figure 2.13, there is more than three quarter of ordinary users of online learning system are giving out the agreement that their current online learning system should be improve by supplying more information of how far it helps in protecting environment.

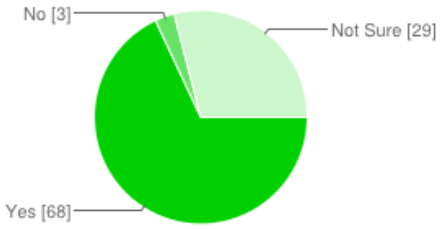
What will you want to know about using online learning system in term of Eco-Audit and green computing?



Number of pages paper saved	**63**	63%
Number of tree saved	**84**	84%
Other	**7**	7%

Figure 2.4 :Analysis result of what will the respondents wish to know about Eco-Audit in their online learning system

Do you feel that there should be an improvement on current online learning system by applying Eco-Audit?

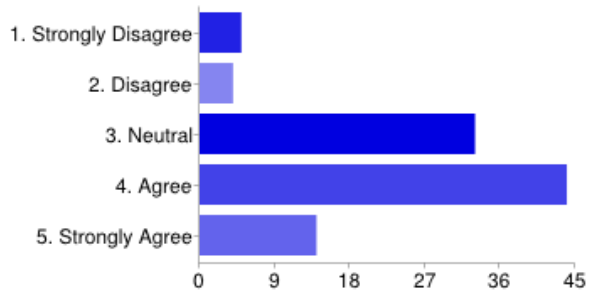


Yes	**68**	68%
No	**3**	3%
Not Sure	**29**	29%

Figure 2.5 :Analysis result of whether respondents want improvement on their online learing system by using Eco-audit

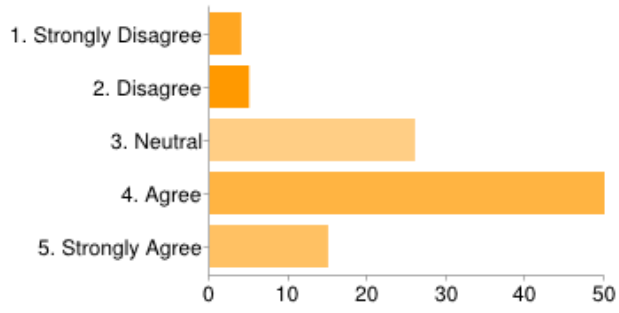
In order to get requirement from user on Eco-Audit term, we are survey on users opinion of getting what kinds of information they get to know in Eco-Audit system implement in online learning system that shown in figure 2.14. For the results, most of them are interested to know the number of tree saved and the second one is number of pages paper saved. There is also other suggestions by respondents which are the amount of electical energy have saved from using their online learning. Besides, 68% of respondents are feeling that their current online learning system should be improve with applying Eco-Audit tool as shown in figure 2.15.

I think that Eco-Audit in online learning system provide a lot of information about paper saving to increase users awareness on environmental issues.



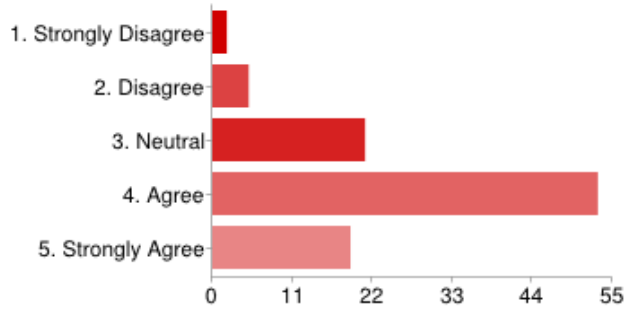
1. Strongly Disagree	**5**	5%
2. Disagree	**4**	4%
3. Neutral	**33**	33%
4. Agree	**44**	44%
5. Strongly Agree	**14**	14%

I will found it is more interesting if I can know the number of paper I can save with using online learning.



1. Strongly Disagree	**4**	4%
2. Disagree	**5**	5%
3. Neutral	**26**	26%
4. Agree	**50**	50%
5. Strongly Agree	**15**	15%

I will think that online learning system is Eco-friendly in higher education field with implementation of Eco-Audit tool.



1. Strongly Disagree	**2**	2%
2. Disagree	**5**	5%
3. Neutral	**21**	21%
4. Agree	**53**	53%
5. Strongly Agree	**19**	19%

Figure 2.6 :3 Analysis result of how respondents response to Eco-audit in online learning system

Overall, there is high portion with nearly fifty percentage of the users of online learning support and agree with the implementation of Eco-Audit in online learning system since they feel that it will provide information about paper saving to increase users awareness on environmental issues. They also agree that they will feel more interested to use online learning system if they get to know the number of paper they save and it is Eco-friendly to be encouraged to implement with Eco-audit tool in education field especially high education level as shown in the analysis result of figure 2.8.